

PATENT  
TH0681 04 (US)  
DFH:EM

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	)	
	)	
DAVID M. SINGLETON, LOUIS KRAVETZ,	)	
BRENDAN D. MURRAY	)	
	)	
Serial No. 11/748,976	)	Group Art Unit: 1796
	)	
Filed May 15, 2007	)	Examiner: Necholus Ogden Jr.
	)	
HIGHLY BRANCHED PRIMARY ALCOHOL	)	November 5, 2008
COMPOSITIONS, AND BIODEGRADABLE	)	
<u>DETERGENTS MADE THEREFROM</u>	)	

COMMISSIONER FOR PATENTS  
P. O. Box 1450  
Alexandria, VA 22313-1450

Sir:

DECLARATION UNDER RULE 132

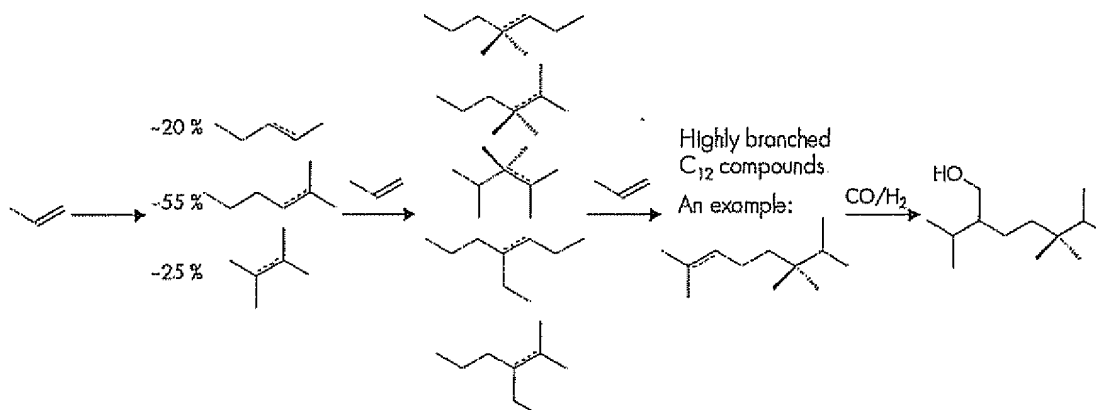
William Warren Schmidt hereby declares:

THAT he received an A.B. in Chemistry from the University of Tennessee at Chattanooga, Magna Cum Laude, in 1967; and that he received his M.S. Degree in Chemistry in 1969 from the University of Tennessee; and he received his PhD in Organic Chemistry from the University of Tennessee at Knoxville in 1975; and

THAT he has been employed by Shell Oil Company or one of its related companies since 1987 and has worked in the areas of the structure/property relationships of surfactants, the utility of alcohol-based surfactants, especially as detergent structures changed, the formulation of liquid detergents, the investigation of the detergency of alcohol ethoxylates, and the utility of alternate hydrophiles for surfactants; and

THAT, as described by Grifo, U.S. Patent No. 2,766,212, column 2, lines 9-13, the alcohols were prepared using the "oxo process" starting with olefins such as the "tetrapropylene" that was used to prepare the oxo tridecyl alcohol used in the examples; and

THAT the reaction sequence below depicts how such olefins, specifically tetrapropylene, were prepared in 1956 and displays representative structures; and that in the absence of comment or teaching, the catalyst for the olefin production is presumed to be an acid as described in Chemistry of Organic Compounds, 3rd Edition, by Noller, 1965, pp. 102-103 which describes olefin self-addition (see the bottom of p. 102 for mention of propylene tetramer); and



propene (I) → dimers (II) → trimers (III) → tetramers (IV) → isotridecanols (V)

THAT the dimers (II) will be approximately 80% branched and 20% linear and when the next propene is added, a very complex mixture (III), with little, if any, residual linear olefin is formed (five of the many possible structures are shown and three of the five structures have a quaternary carbon); and with the addition of the fourth propene, a complex mixture of greater than twenty olefins (IV), many of which have a quaternary carbon, is formed (only one of these has been drawn, a tri-methyloctene with a quaternary carbon); and that the use of an acidic catalyst facilitates alkyl group migration, thus increasing the number of isomers and the complexity of the structures; and

THAT the oxo reaction (V) with carbon monoxide and hydrogen yields a similarly complex mixture of alcohols which will also contain quaternary carbons (again only one of many possible isomers has been depicted); and

~~THAT the oxo tridecyl alcohols made by Grifo would have been comprised of many~~  
isomeric structures, a substantial number of which would have had quaternary carbon atoms and  
that the mixture would have had much more than 0.5 atom percent of quaternary carbon atoms; and  
that the oxo tridecyl alcohols would have exhibited poor biodegradability.

William Warren Schmidt further declares that all statements herein of my own  
knowledge are true and that all statements made on information and belief are believed to be true;  
and further that these statements were made with the knowledge that willful false statements and  
the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of  
the United States Code and that such willful false statements may jeopardize the validity of the  
application or any patent issued thereon.

Date November 5, 2008

William Warren Schmidt  
William Warren Schmidt

3rd Edition

CHEMISTRY  
*of*  
ORGANIC  
COMPOUNDS

CARL R. NOLLER

Professor of Chemistry, Stanford University

W. B. SAUNDERS COMPANY  
*Philadelphia and London*

1965



ence of an acid catalyst twice the molecular weight (hence *two parts*). The

of water to the double bond according to the Markovnikov rule to the acid and adds to the

$\text{H}-\text{CH}_3$

case with the formation of a carbon adjacent to the

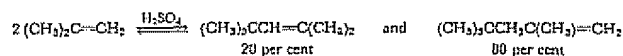
reactions illustrating the necessity of rewriting for the minor product of the first reaction of 1-butene with loss of a methyl group and third equations, showing a carbonium ion with a methyl group. It will be observed that the methyl group does not appear

ene gives a trimeric product. A fourth molecule of ethylene always contains a methyl group. It repeats itself until the reaction is exothermic because of the formation of about 20 small parts and they are formed in place by addition, it is. Although the acid phosphoric or sulfuric acid or aluminum chloride also ini-

polymer

the production of propylene trimer, synthetic detergents, and a film of

phosphoric acid on quartz granules. If isobutylene is passed into cold 60 per cent sulfuric acid and the solution is heated to 100°, a mixture of dimers and trimers (about 4:1), together with smaller amounts of higher polymers, is formed. The mixture of dimers is known as diisobutylene and consists of four parts of 2,4,4-trimethyl-1-pentene and one part of 2,4,4-trimethyl-2-pentene (cf. p. 96).



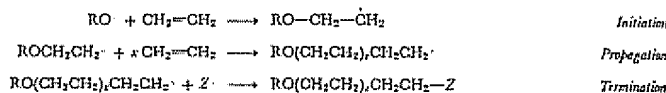
Catalytic hydrogenation of the mixed diisobutylene yields 2,2,4-trimethylpentane, the standard 100-octane motor fuel (p. 110).

The trimers and higher polymers are formed by reaction of the dimers with more isobutylene. If boron fluoride or anhydrous aluminum chloride is used as a catalyst at -100°, polyisobutylenes having from 400 to 8000  $\text{C}_4\text{H}_8$  units and varying from sticky viscous resins to elastic rubber-like solids are obtained.

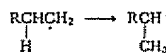


The acid-catalyzed polymerization of olefins gives as products only viscous semisolids of high molecular weight. In 1938 a patent was issued in Great Britain for the production of a solid polymer of ethylene. The polymerization is carried out above 100° and at pressures above 15,000 p.s.i. in the presence of 0.01 per cent of oxygen. The molecular oxygen, with its two unpaired electrons of like spin (p. 14), acts as a free radical initiator. Free radicals generated by the thermal decomposition of organic peroxides (p. 101) also may be used.

The free radical,  $\text{RO}\cdot$ , starts a chain reaction (p. 47), which is terminated by the union with any other free radical,  $\text{Z}\cdot$ , with which the growing chain may collide in the proper way. Usually  $\text{Z}\cdot$  is another growing chain.



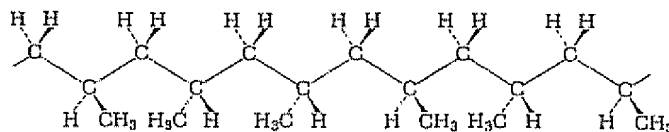
The product, called polyethylene, is a linear polymer but contains about one methyl branch for every 8 to 10 methylene ( $\text{CH}_2$ ) groups. The branching results from the occasional shift of a hydrogen atom during the polymerization.



Various catalysts, such as the so-called Ziegler catalysts, for example titanium tetrachloride and an alkylaluminum (p. 130), have been developed that not only permit polymerization to take place at essentially atmospheric pressure but also reduce the amount of branching and yield a denser and more rigid polymer called *high density polyethylene*.

The polyethylenes are *thermoplastic*; that is, they soften and flow on heating because the molecules can slip past each other. In this condition they can be extruded into sheets and various shapes, which solidify on cooling. Because polyethylenes are saturated hydrocarbons, they are very inert, and their high molecular weight makes them insoluble in most solvents. During 1963, United States production reached 2.3 billion pounds.

In the polymerization of substituted olefins such as propylene, the usual catalysts give a random spatial arrangement of the polymeric units as in (a) with the result that the attractive forces between the chains are not strong, and the products are oils and sticky semisolids. The catalysts that produce high density polyethylene (p. 103), however, give an ordered arrangement of the polymeric units as in (b) with the result that a useful product is obtained. Polymers with a random arrangement of units are said to be *atactic* (Gr. *an* not,



(a) Section of atactic polypropylene chain.